

Greening of Engineering Revisited

Andrew "A.J." Janitschek
Radio Free Asia
Washington DC

ABSTRACT - *For the 2009 NAB Show I co-wrote a paper about 'greening of broadcast engineering'; the paper was titled, GOT GREEN? AN ENGINEERS GUIDE. Greening was a growing trend at the time. Today, it is not new or trendy, but it has become a standard part of our broadcast work. In this paper, you will find green information that builds upon common factors and at the conclusion, illustrates how Radio Free Asia (RFA) has moved forward since then by 'greening our engineering' in RFA's Washington DC facilities. Everything from computers, studio lights, and even the use of paper towels are all served by greener solutions today. All of which would not have been possible without RFA broadcast engineers employing greener solutions; many of which you can apply too.*

GO GREEN!

Making broadcasting a more environmentally friendly industry is not new but it is undoubtedly one of the most important goals for broadcast managers and engineers in the 21st century. Conserving resources, and repurposing them when possible, is a challenge we all face not only at work but also at home. "Greening" broadcast engineering not only takes planning and coordinating, but it also takes commitment and a real human effort.

Recycling and repurposing are not simply options, but an integral part of smarter, greener engineering. Greener engineering not only helps your bottom line and contributes to a better environment, but encourages and can engage all company personnel in greening too. It is incumbent upon employees and management to pick up the banner of social responsibility in a world where resources are clearly limited and supplies of many are dwindling. A great place for a broadcast engineer to start is right at the top, with company management; enlist their support in your greening efforts.

DECOMPOSITION – HOW LONG?

It is important to understand how long it takes many of our everyday products to decompose. Man-made materials decompose at different rates depending on the where it comes to rest. For example, Styrofoam is estimated to take 500-1000 years to decompose. Temperatures, oxygen and moisture levels, and pollutants can all effect how quickly, or slowly, something breaks down. By the way, anything buried underground will take longer to decompose. Here are the decomposition rates of many common items (Source: California Waste Management Bulletin):

Banana/orange Peel	2-5 weeks
Cigarette butt	1-5 years
Plastic bag	10-20 years
Aluminum can	200-500 years
Plastic 6-pack cover	450 years
Glass bottle	1 million years

ENERGY STAR

The Environmental Protection Agency (EPA) is the federal agency at the forefront of America's effort to create a greener nation. Since 1970 the EPA is charged with protecting our health by safeguarding our air, water, and land. ENERGY STAR is joint program of the EPA and the US Department of Energy (DOE) that sets standards of energy efficiency. ENERGY STAR certifications are applied to electronic products, lights, homes, industrial building, and even heating, ventilation and air conditioning (HVAC) systems.

One important step to a greener community is to purchase products certified with the Energy Star logo whenever possible. According to the EPA, "Results are already adding up. Americans, with the help of ENERGY STAR, saved enough energy in 2010 alone to avoid greenhouse gas emissions equivalent to those from 33 million cars — all while saving nearly \$18 billion on their utility bills." Energy Star remains one of the most recognized and successful efforts in greening our lives. Energy Star helps us all save on our energy bills and also helps fight global warming through energy efficiency.

As a broadcast network, Radio Free Asia uses a great deal of office equipment. Energy Star reports, "If every home office product purchased in the US ... were ENERGY STAR qualified, Americans would save \$200 million in annual energy costs while preventing almost 3 billion pounds of greenhouse gases – equivalent to the emissions of 250,000 cars." Office equipment earns the Energy Star seal through special energy-efficient designs, which lets them perform normal tasks while using less energy and automatically entering a low-power mode when not in use.

Here are a few steps the EPA recommends that managers can take to reduce energy waste, lower costs, and protect the environment:

- Create and distribute an energy policy.
- Use the Portfolio Manager Tool at EnergyStar.gov/Benchmark to track your energy data, establish energy usage baselines, benchmark your facility against others, analyze energy use patterns and

trends, and prioritize areas for improvement. At RFA's facility, Carr Properties manages the building; they use the software available from Mach Energy (an ENERGY STAR Partner) to provide on-demand energy information and management.

- Earn the Energy Star certification for your building. Together, RFA and Carr Properties are committed to working together for an ENERGY STAR rating in the near future.

Broadcast engineers can be assigned to manage and maintain company buildings and their infrastructure. Here are tips on making your buildings more energy efficient now:

- Give Your Building a Tune-Up. Regularly examine building equipment, systems, and maintenance procedures to ensure everything operates efficiently.
- Improve the Lighting. 25-30 percent of the energy used in a commercial building is just for lighting. Improvements to your lighting systems so you can cut back on the use of electricity. Look for opportunities to turn off lights. Replace old bulbs with ENERGY STAR qualified compact fluorescent lights (CFLs). Lastly, use motion detection controls to dim or brighten lights.
- Look Inside and Out. Purchase Energy Star qualified office equipment whenever possible.
- Upgrade Fan Systems. The best fan systems handle optimal air capacities, have variable speed drives, and convert to a variable-air-volume system.
- Set your standards high HVAC systems. They offer great opportunities for energy savings.

No matter how small or larger your network of buildings, these recommendations will help you go a long way towards greening your broadcast engineering.

2011 AWARD WINNERS

Each year the EPA and DOE honor businesses and organizations for outstanding contributions to reducing greenhouse gas emissions through their energy efficiency. You should recognize the names of many of these 2011 Energy Star Award winners:

Canon U.S.A., Inc. is a leader in professional and consumer imaging equipment and information systems. Canon received ENERGY STAR recognition for expanding its energy-efficient product line which resulted in substantial energy savings. For example, they added 57 new ENERGY STAR qualified models to its suite of products. One hundred percent of Canon's suite of copiers, printers, scanners, and fax machines, and over 99 percent of its multifunction devices have earned the ENERGY STAR. Canon U.S.A. also introduced software which helps users track and monitor devices, and perform comprehensive environmental assessments; this helped users get the optimum energy and resource savings from their Canon products. They expanded customer awareness about the ENERGY STAR program by

including discussions about ENERGY STAR in sales training and dealer and customer presentations and Canon reduce the use of electricity in the Lake Success, NY facility by 5 percent, saving 1.35 million kWh, in part through EPA's Low Carbon IT Campaign, as well as through additional energy-saving measures. Canon also increased its energy efficiency target by an additional 5 percent for the year.

Serving more than 30 million customers, DIRECTV is the nation's top satellite television service provider. To win the annual ENERGY STAR award, delivered more than 20 million energy-efficient satellite boxes to their customers which will translate in larger energy savings in the years to come. DirecTV trained numerous employees and contractors about the value of their ENERGY STAR satellite boxes, developed environmentally friendly shipping containers that reduced packing 75 percent from the previous year and they standardized their satellite dish mounts the let installers reuse the mount even during a system upgrade.

3M is well known, global technology company with a strong commitment to energy management. 3M set aggressive energy goals with support from senior managers. They continually tracked monthly energy use at 212 locations worldwide. This helped 3M improve energy efficiency by 4.5 percent over previous usage and saved 3M than \$18 million in energy costs. They designated \$1 million to fund and launch additional energy projects in support of their commitment to continuous energy improvement and 3M completed 53 energy efficiency projects in 2010, saving \$7.77 million. They formed research and business partnerships and awarding \$150,000 in grants to educators to address energy and renewable energy issues and 3M made it a point of combining energy efficiency into the building plans for their new headquarters in Italy and New Zealand. They also certified engineering service providers for their energy efficiency prior to awarding them work.

Another winning of a 2011 ENERGY STAR Award is Sharp Electronics Corporation (SEC). Based in Mahwah, NJ, SEC is a subsidiary of Japan's Sharp Corporation, and manufactures professional and consumer electronic products; SEC is also involved in solar electricity markets. They were recognized for offering consumers an array of exceptionally efficient, fully featured electronics. SEC brought to market low energy AQUOS Quattron televisions which are 65 percent more efficient than LCD CFL backlight television; the SEC models are also mercury free. They offered 51 ENERGY STAR qualified televisions, including 60-inch models that met the same stringent ENERGY STAR requirements of using on 108 watts like their smaller televisions. For the first time, all of their professional LCD monitors earned the ENERGY STAR. Lastly, SEC dealers, retailers, and consumers on the importance of energy efficiency, provided recycling for all Sharp products, and supported environment-friendly manufacturing Japan by generating solar power, using LED lighting, using 100 percent recycled water for LCD

manufacturing, and discharged zero waste to landfills, while in Memphis, TN, SEC installed a 150 kW solar system to complement the existing 50 kW system.

Samsung Electronics Co. in Taegu, South Korea is a leader in high-tech electronics and digital media including semiconductors, thin film transistor (TFT) LCDs, monitors and code division multiple access (CDMA) mobile phones. Some of the reasons Samsung received their award are bringing a broad range of ENERGY STAR qualified products to market and teaming with numerous partners to promote energy efficiency. This included educating customers by actively supporting the Change the World, Start with ENERGY STAR campaign, promoting ENERGY STAR pledges through the use of an LED TV sweepstakes, active participation in their Boys and Girls Club of America partnership, and promoting the concept of efficiency and the campaign across the nation with Samsung's RV Tour 2010. Besides these accomplishments, Sharp offered 930 ENERGY STAR qualified products, including all Samsung televisions, clothes washers, dishwashers, refrigerators, computers, and multifunction devices. Sharp stimulated lower energy consumption by up to 30 percent in televisions with LED backlighting and Automatic Brightness Controls. Lastly, Sharp cut their energy use at its Rancho Dominguez location by 80 percent through the use of solar panels; the energy collected through these panels were used to power their fleet of electric vehicles.

LEED IN BROADCASTING

Many engineers are unfamiliar with the terminology, technologies and standards involved in greening and building green facilities. As broadcasters approach a green building project or renovation, Leadership in Energy and Environmental Design, or LEED, certification should be considered. Getting LEED certification has several advantages. LEED-certified buildings use key resources more efficiently than conventional buildings. They are also healthier work environments demonstrated by higher employee productivity and less absenteeism. Among other advantages of LEED certification are reduced environmental impact on the construction site, improved air and water quality, and reduced solid waste.”

The US Green Building Council (USGBC) developed the LEED standards for design, construction and operation of environmentally sustainable buildings. These standards address a number of areas like air and water quality, energy, efficiency, pollution and the responsible management of natural resources. The LEED Green Building Rating System is a third-party certification program and the nationally accepted benchmark for the design construction and operation of high performance buildings. LEED provides building owners and operators with the tools they need to have an immediate and measurable impact on their buildings' performance. LEED promotes a whole-building approach to sustainability by recognizing performance in five key areas of human and environmental health:

sustainable site development, water savings, energy efficiency, materials selection and indoor environmental quality. LEED for Existing Buildings addresses whole-building cleaning and maintenance issues, use of chemicals, recycling, exterior maintenance programs, and systems upgrades. It can be applied both to existing buildings seeking LEED certification for the first time and to projects previously certified under LEED for New Construction, Schools, or Core & Shell. LEED-certified buildings:

- Lower operating costs and increase asset value.
- Reduce waste sent to landfills.
- Conserve energy and water.
- Are healthier and safer for occupants.
- Reduce harmful greenhouse gas emissions.
- Qualify for tax rebates, zoning allowances and other incentives in hundreds of cities.
- Demonstrate an owner's commitment to environmental stewardship and social responsibility

Electronics improve the way we live, work and play but there is one place where electronics should have no impact—the environment. Through responsible use, reuse and recycling of electronics, the consumer electronics industry and consumers can protect and preserve the environment together.

Along with ENERGY STAR, EPEAT is a global registry for greener electronics. It's an easy-to-use resource for purchasers, manufacturers, resellers and others wanting to find and promote environmentally preferable products. Based on values of leadership, transparency, continuous improvement, collaboration and market-orientation, EPEAT operates one of the most successful global environmental rating systems for electronic products, helping connect purchasers to environmentally preferable choices, and thereby benefiting producers who demonstrate environmental responsibility and innovation. So look for the EPEAT label! Their simple point is to reduce energy usage and reduce e-waste. Responsible, energy-conscious use of electronics saves energy, money and the environment. To manage the growing problem of e-waste, or electronics being thrown away, you can extend the life of your electronics with proper care, fix your gear first before trying to recycle, or donate your used electronics since your outdated model could be a welcomed resource for someone else. Therefore, reuse or repurpose your electronics; older electronics that still work can be put to good use.

GREEN RADIO WORLD

In 2008 Radio World launched a series called Green Radio. It provides readers articles on how radio is "going green." As part of Radio World's Green Radio series, they published the following list of top ten technologies that help radio, television, and as a matter of fact, all of us go green. Here it is in its original form:

Green roofs, both reflective and vegetative, help reduce the urban "heat island" effect by minimizing a building's absorption of solar radiation.

- Gray water systems recycle water from sinks and water fountains to be used in toilets and other non-drinking applications. Captured rainwater may also be used.
- Geothermal heat pumps transfer heat from the ground to buildings in the winter and reverse direction to provide cooling in the summer. They may be built anywhere in the United States.
- Tubular skylights are less costly than conventional skylights, distribute light evenly, are energy efficient and don't cause ultraviolet damage to carpets and furniture.
- Eco Machines treat wastewater in natural processes that combine microorganisms, plants, snails and fish to clean water, which can then be used for irrigation.
- Daylighting uses exterior light through windows and skylights to illuminate a building's interior, reducing electricity demand during the day. Taller floors and light shelves permit natural light to penetrate further into the building. Daylight sensors turn off artificial lighting when daylight is sufficient.
- Right-sized HVAC guidelines enable more accurate estimates of heating and cooling loads. A right-sized system will operate for long periods of time, rather than cycling on and off, resulting in longer equipment life and better control of the indoor environment.
- Wireless controls and sensors for heat, lighting and security require less installation time than their wired counterparts and add flexibility. To control multiple pieces of equipment or temperature from multiple locations, just wall-mount additional wireless thermostats or controls.
- High-performance windows have triple-pane glass and double-skin windows that reduce heating and cooling loads as well as draftiness and moisture condensation. On some double-skin windows, the inner windows can be opened to increase ventilation.
- Concentrator photovoltaic (CPV) technology achieves greater efficiency than flat panel photovoltaics by using mirrors or lenses to concentrate solar energy onto smaller areas of PV material.

RFA DOES GREEN

In the past two years Radio Free Asia has made changes to green our own operations: installing CFL and LED lighting where possible, replacing paper-towels in restrooms with low energy hand dryers, and promote lower energy usage by having broadcasters turn off studio lighting when not in use.

When RFA was built in 1996, little concern was put in place for energy efficiency. A consultant helped design the lighting for hallways, studios and other areas. Halogen was

in! In the last few years though, halogen is out and have been replaced by CFLs, and more recently, LED lights. While the energy savings from the newer bulbs is obvious, they do come with a higher purchase price than the previous bulbs. Decades of production, competition, and market saturation drove prices of everyday incandescent and halogen lighting down. CFLs and LED on the other hand are not as cheap and only recently are experiencing huge demand. The fact that CFLs and LED lights are available globally is a start.

The availability of incandescent lights may be doomed. Some governments have passed measures to phase out incandescent lights. The aim is to encourage technological development of more energy-efficient lighting and also encourage more global use of CFLs and LED bulbs.

CFLs are more energy efficient, but have been known to be a safety hazard when a non-dimmable CFL is used in a circuit with a dimmer. Also, because of the mercury content of CFLs, they remain a health and safety concern when they are thrown away. If all electricity was generated by a coal power plant (which produce about half the electricity the U.S. consumes) and fluorescent light bulbs were all recycled with no mercury being lost nearly 75% less mercury could be released in power plant emissions if incandescent bulbs were replaced by fluorescents. To date, CFLs are still used throughout RFA, especially for all ceiling lighting in our Master Control, and all hallway lighting throughout our facility. The CFLs are provided by our building management as part of our lease agreement, so CFLs, per se, are a no-cost item for RFA.



FIG 1 TYPICAL CFL USED IN RFA'S MASTER CONTROL

LED lighting works very well, but at a cost. Incandescent bulbs were cheap; RFA paid less than \$1 for each 60-75 watt bulb. RFA paid \$5 each for the older 75 watt PAR30 halogen bulbs used in our hallways and studio's. A good part of the heat load in each audio studio was caused by the 75 watt PAR30 halogen lamps we used. We went through 'sticker shock' when we found out how expensive an equivalent LED bulb was and that we had to order a minimum of 50 in order to get any pricing discount. At just over \$60 per light, and needing 4 bulbs for each main studio and 2 bulbs for each small studio, it was hard to justify the cost even if there was a long term savings. Compared to a 75 watt halogen though, the energy consumption and the years of service expected from each equivalent 21 watt LED light actually makes them cost-

effective over the long haul. LED bulbs provide high-quality white light, they reduce energy costs significantly, and they help preserve our environment. By reducing greenhouse gasses and shrinking our carbon footprint, they are better for the environment. They are also easy to use because they are designed in traditional bulb shapes and not only fit into existing fixtures but they also come in dimmable versions too. The cooler burning LEDs require studio air conditioners to work less when compared to cooling a studio that previously used halogen bulbs.

At RFA we still run into problems with broadcasting staff that forget to turn off the studio lights when they depart, so we are somewhat comforted by the fact that even though there is some waste of electricity, the waste is minimized by our use of LED lighting.

Since the LED lights are costly, we limit our supply to no more than 13 LED bulbs on bench stock and as an in-studio halogen reaches the end of its life, we replace them with the LED light. We know this is a tradeoff in getting the most out of older lights we've purchased, and then cutting our energy consumption as we slowly transform our studios from halogen to LED lighting. The specific Philips part number for the short dimmable LED R30 lamp we need is: 12PAR30S/END/2700/120V/DIMM/22D. The "S" in the part number is the important part for us as it reflects the short version that we needed for our studio track light fixtures.



FIG 2 PHILIPS LED USED IN RFA STUDIOS

While the LED bulbs are expensive, they do consume less energy, produce less heat, and last significantly longer. The new LED bulbs are rated to last approximately 50,000-60,000 hours; that is 5.7-6.8 years of continuous use if the LED bulb is used around the clock versus the standard 2,000 hours, or about 83 days, of continuous use for the halogen lamps. The standard halogen lamps are only rated for 2,000 hours, or 83 days, of continuous use. Additionally, each LED bulb only uses 21 watts which is about 30% of the 75 watts needed for each halogen lamp. We purchased two samples to test, each of a differing color temperature; cool white and warm white. The overall consensus was that warm white provided the most pleasing light.

LED's are solid state lighting devices that utilize semiconductor materials instead of filaments or neon gas.

An LED light is a tiny chip encapsulated in an epoxy resin enclosure, making LED's far sturdier than traditional incandescent light bulbs and fluorescent tubes. LED lights do not use fragile components such as glass and filaments, so LED's can more effectively withstand shock, vibration and extreme temperatures. Since LEDs generate little to no heat, they are safe to the touch and drastically reduce the risk of fires, especially when used in video and stage productions. This means LEDs are always cool and can be left on for hours without incident or consequence. LED's produce 3.4 btu's/hour while incandescent bulbs produce 85 btu's/hour.

Will we see the end of incandescent bulbs soon? As of this writing, federal efficiency standards will begin with 100-watt bulbs and end with 40-watt bulbs. The standards were to go into effect in January 2012, but on December 16, 2011, the U.S. House passed the final 2012 budget legislation, which delayed the implementation of the federal standards until at least October. Bulbs outside of this range are exempt from the restrictions. Also exempt are several classes of specialty lights, including appliance lamps, rough service bulbs, 3-way, colored lamps, stage lighting, and plant lights.

DYSON AIRBLADE HAND DRYERS

In 2010-2011 RFA experienced a series of problems with an overabundance of paper-towels being disposed in our toilets. This caused minor flooding the restrooms and not only interrupted the daily workflow, but also cost additional money for our building engineers as they had to unstop the toilets and mop up the excess water. Because of the additional cost of paper towels, and cleaning up after overuse and/or abuse of the towels, we worked with building management to replace the towels in the restrooms of all three floors we occupy. We expressed the need and our building managers chose the units and took care of arranging the installation. What was selected was the Dyson Airblade; many are seen around the world in public restrooms. According to Dyson, "The Dyson Airblade hand dryer dries 22 pairs of hands for the cost of a single paper towel!" and "after 12 seconds of use, the Dyson Airblade hand dryer reduces the transfer of bacteria from hands by up to 40%." In the year since they have been installed, we believe we have saved enough money in paper-towels and potential plumbing repairs to have the units begin to pay for themselves, if not completely do so, if one follows the graphic below from Dyson's energy savings calculator. Here are the basic specs of the Dyson O2:

- Electrical supply: 110-120 V AC, 60 Hz
- Rated power: 1400 W
- Motor type: Dyson digital motor. Switched reluctance brushless
- Motor speed: 81,000 rpm
- Heater type: None
- Standby power consumption: 1 W
- Energy consumption per dry: 0.00468 kwh

- Anti-microbial HEPA filter

When using the energy calculator available at the Dyson website, we calculated a rough savings of \$15,000-\$20,000 annually based on no longer buying paper towels for each bathroom on all 3 floors occupied by RFA. Even if these numbers are optimistic, we feel that within a year or two from the day they were installed, each Dyson Airblade will have paid for itself.

GREEN TEAMWORK

Some of the other initiatives taken at RFA to help support our efforts of greening are two separate signs on the inside of every studio which broadcasters see when they depart; one sign is a reminder to turn off all microphones when done; the other is a reminder to turn off all studio lights when leaving. When turning off the microphones, both the in-studio and external On-Air lights are also turned off, thus saving electricity and extending the life of the On-Air light bulbs. When the studio lights are cut off at the end of a recording session, we garner further power savings from the non-use of the lights and the reduced demand on our studio air conditioning system.

A few other ideas we have implemented to make our operations greener is to allow the staff to bring their own plants into their workspace (plants provide fresh air and a more comfortable atmosphere) and encourage the staff to recycle paper by printing on the unused side of any 8.5' x 11" paper. While not required, some do try to print a disclaimer at the bottom of each page; something to the effect of, "PLEASE DISREGARD REVERSE – RECYCLED PAPER."

SUMMARY

We will continue to tweak and improve on our efforts to green our operations and engineering at RFA. The application of 'greening' to broadcast engineering not only takes planning and coordinating, but it also takes commitment and a real effort. Working along with our broadcasters, building management, and suppliers, we hope to save more energy in the future, and repurpose or recycle as much as possible in the years to come. We have come a long way from where we were just a few years ago and only time will tell what our greening of broadcast engineers will look like in the future. See you then.